



Application Number; 10/084, 072

Group Art Unit Number: 3635

Filing date; 02/27/2002

Name of the examiner who prepared  
the most recent office action;

Mr. MCDERMOTT, KEVIN

Title of invention;

SUPPORT STRUCTURE FOR ISOLATING  
EARTHQUAKE MOTIONS

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SPECIFICATION

RECEIVED  
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remarks;

a) The amendments to the Specification was  
made by presenting replacement words and  
paragraphs marked up to show the immediate  
prior version.

The changes in amended specification were  
shown by strike through (for deleted matter)  
and underlining (for added matter).

b) The amendment to the specification was made  
so as to coincide with the changes to the  
drawing figures.

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Proposed AMENDMENTS to the SPECIFICATION

SUPPORT STRUCTURE FOR ISOLATING EARTHQUAKE  
MOTIONS

BACKGROUND OF THE INVENTION;

The present invention has to do with a support  
structure for isolating earthquake motions, and  
more particularly, to prevent a chain  
vibrations of the structure from earthquake  
and/or wild storm such as hurricane etc.

Heretofore, conventional earthquake-proof con-  
structions are based on methods to alleviate  
gearing of earthquake motions by intermediately  
connecting elastic materials such as springs,  
rubber, lead, and balancer etc. between said

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foundation and bottom of structure.

Present invention is to provide another unique  
method to isolate linkage vibration of the  
earthquake and wild storm to ~~above~~ upper part of  
a structures taking advantages of friction-  
less nature ~~in point contact rolling~~ of a number  
of large and small steel balls rolling in point  
contact.

#### SUMMARY OF THE INVENTION;

The present invention ~~is designed~~ was made to  
put a constructions on a collective block of fri  
ctionless large and small steel balls.

Explaining my invention in more detail, the

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device is designed to interpose large and small  
balls between pressure-receiving spherical curved  
steel plate and pressure-applying spherical  
curved steel plate ~~surfaces~~ as shown in annexed  
drawings (Fig. 2-A~Fig. 2-C), hence transmission of  
earthquake motions are isolated by above said  
rolling of two types of balls interposed between  
the two curved spherical surfaces as soon as  
earthquake occurs. This is the case just like the  
case of a ship on the water, in which we have no  
earthquake feeling since trembles are isolated  
by allowing the waving water to receive and  
transform them into rolling forces of the water  
wave.

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A preferred form of the present invention is  
illustrated in the accompanying drawings in  
which;

Fig. 1 is a plan view of the invention showing a  
~~foundation~~ foundation hoop trembled from the east  
to the north direction.

Fig. 2-A is a sectional view of a composition of  
~~fundamental~~ foundation hoop, a column, and a  
foundation showing a frictionless slide of the  
invention.

Fig. 2-B is a sectional view of a main portion  
of the invention where the large and small balls  
arranged between two spherical steel plates.  
tionless showing a frictionless slide part of

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the invention.

Fig. 2-C is a enlarged sectional view of the  
same portion of the invention where large balls  
and small balls are shown in large scale.

Fig. 2-D is a sectional view of a foundation por-  
tion with a colum in image.

Fig. 3 is a imaginary view of a linkage movement  
of a foundation hoop when an earthquake occurs.

Fig. 4 is a perspective view of a sliding frame  
for sliding balls when earthquake motions were  
isolated.

Fig. 5 is a perspective view of the hoop of the  
invention.

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Fig. 6 is a perspective view of the hoop of a the  
invention.

~~Fig. 7 is a perspective view of portion which  
closed for large balls and opened for small  
balls.~~

Fig. 8 is a sectional view of press working of  
a concave curved surface and a convex curved  
surface.

~~Fig. 9 is a partial perspective view of a holes.~~

~~Fig. 10 is a partial perspective view of a frie-  
tionless sliding concave portion.~~

Referential numerals in the drawings;

1-- foundation hoop

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2--connecting bolts ~~of~~ for connecting a convex  
curved surface ~~and~~ with concave curved surface

3--pressure-receiving large steel balls (10.318mm in  
usual case)

4--rolling unifying small balls (8.73mm in usual case) in  
point contact

5--concave steel steel plate with pressure-  
receiving surface

6--convex steel plate with pressure-applying  
spherical surface

7--ball aligning frame

8--sodium silicate

9--column

10--liquid replenishing pipe



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11--liquid sealing packing

12--polybinyll chloride ball cover

13--conclete covering all the surface of top  
and bottom steel plate

14--connecting steel frame for hoop tightening

15--connecting steel frame for hoop-tightening

16--iron and steel reinforced concrete block

17--bolts for pressing ball surface

18--pressing bolts and nuts

19--tightening portion for balls

20--concrete frame

21--pressing slot

22--iron frame for ball surface

23--foundation hoop (same as numeral 1)

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24--hoop tightening frame

25--ball sliding block

#### DETAILED DESCRIPTION OF THE INVENTION:

According to my invention, large steel balls (3)  
and small steel balls (4) are interposed between  
pressure-receiving spherical curved steel plate 5  
and pressure-applying steel plate (6) as shown in  
~~the drawing 1~~ (Fig 2-A~Fig. 2-C).

The peripheral scales of these plates are adjusted  
with that of a bottom of a structure such as a  
house or building to be built.

These plates are made of steel and used as a  
ball receiver.

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The shape of said pressure-receiving plate (5) is recessed concave formed one and another pressure applying plate (6) is convex formed one.

These ~~oppositing~~ facing spherical plates are used as foundation of the building and also for the purpose of isolating earthquake mortions as described follows.

Pressure-receiving steel balls (3) and pressure-applying small balls (4) with (less accuracy) smaller diameter than that of pressure-receiving large balls are mounted to come in point contact in all direction.

The pressure-receiving concave curved surface (5) is supported by the pressure-receiving steel

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balls (3) and as soon as earthquake occurs, the linkage of earthquake motions to the building is isolated by the rolling slide of said pressure-receiving steel balls (3).

As to the structure of the foundation, a concrete material covering all the surface of top and bottom steel plate with large balls and small balls interposed between them except curved surfaces of the top and bottom plates constitutes a column (9) and the same apply to the foundation. The column (9) including the pressure-applying convex-curved surface is jointed to the foundation including pressure-receiving concave-curved surface by strain adjusting bolts and nuts.

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When the pressure-receiving balls ~~(4)~~ (3) are rolled by the earthquake motions, small bolls ~~(3)~~ (4) interposed throughout the whole periphery of said large balls ~~(4)~~ (3) are rolled simultaneously, in which, as before described, the linkage of earthquake motions to the structure or building is isolated by the rolling slide of the pressure-receiving large and small steel balls.

To cope with jump-up phenomenon caused by directly under earthquake or float-up phenomenon caused by typhoon etc., the hoop (1) is put on the foundation.

The hoop (1), without striving against linkage of earthquake motions, supports colum (9) together

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with the foundation.

Because the steel balls (4) moves to the side of higher foundation pressure-receiving curved surface when the building moves due to hurricane, building mounted on the foundation hoop (1) leans toward the wind pressure direction and increases resistance.

In addition, in order to completely achieve functions of this device, materials with properties of sodium silicate (8), etc., are filled with their properties of rust prevention, anti-freezing, and lubricant maintained are filled and functions of isolating earthquake are held semi-permanently.

The pressure applying and receiving steel plates

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are HRC50 and are free of dent when tested for  
withstanding pressure at 1 ton using pressure-  
receiving steel balls.

Concrete with strength of KGICM/700 are used.

When this invention apply to the colum with  
cross section of 80cm 80cm, the pressure-receiving  
force of 3200 ton is obtained.

#### STRUCTURING PROCESS OF THE INVENTION;

1. viscous materials with properties of rust pre-  
vention is spread and coated onto the plane steel  
plate on spherical curved iron and steel flame  
adjusted so as to fit to a projected structer.

2. fit the hole cast in a projecting pole of

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position frame.

3. Insert all small balls (4) into above said holes  
closing the the holes for balls (3).

4. Pulling up the holes cast horozontally (Fig. 9),  
then, fit a regular holes onto projecting pole.

5. All large balls (3) are casted in free movement.

6. Suffice the NA2S108 to concrete mortar par-  
tition plate by supply pipe, then steel plate  
and block composed iron and steel frame are  
piled on them.

7. Concaved and convexed slide blocks are put on  
press ditch (Fig. 7) and press it by short-term  
clamp bolt-nut by which concaved and convexed



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spherical surface are made.

8. Construct a provisional concrete frame, then  
put concrete into above structured frame.

9. When applying weight reached to exceeding level  
of steel plate rpulsion, provisional frame is  
solved.

10. Fundamental hoop $(i)$  is connected to combined hoop,  
tightening frame by scale of  $1/4$  (Fig. 6). By  
this proceeding the hoop aligns with earth-  
quake motion and wind pressure successfully.